# Advanced Spheromak Reactor

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The spheromak reactor study of Hagenson and Krakowski is updated based on recent theoretical estimates of the energy confinement time and beta calibrated to experiment. The magnetic geometry is designed using a full MHD calculation including current profiles and pressure gradients consistent with the Mercier limit. Coaxial plasma gun designs consistent with maintaining a steady state by helicity injection are presented; the estimate of energy confinement time is based on the resultant current profile and magnetic turbulence. The geometry allows a divertor to handle energy lost across the separatrix, and can have a large surface area because of the lack of external toroidal magnetic field. The gun and divertor may be separable with a double x-point design which permits the gun to drive current from one x-point and the divertor to be on fieldlines beyond the other.

Possible improvements in the concept are discussed, including the possibility of coupling helicity across the separatrix from plasma and current flow only along the outside surface of the separatrix. (This mechanism may have been demonstrated in the Helicity-Injected Tokamak.) The resultant lack of toroidal magnetic field on the separatix maximizes magnetic shear and thus the beta ($\beta_p > 0.2$).

The spheromak continues to be an attractive candidate for a high energy density, conpact fusion reactor both because of the favorable extrapolation of physics to the reactor regime and because of its relative simplicity, including the lack of linked toroidal field coils or a central solenoid for inductive current drive.

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